

photosynthesis



CHAPTER 6

Process



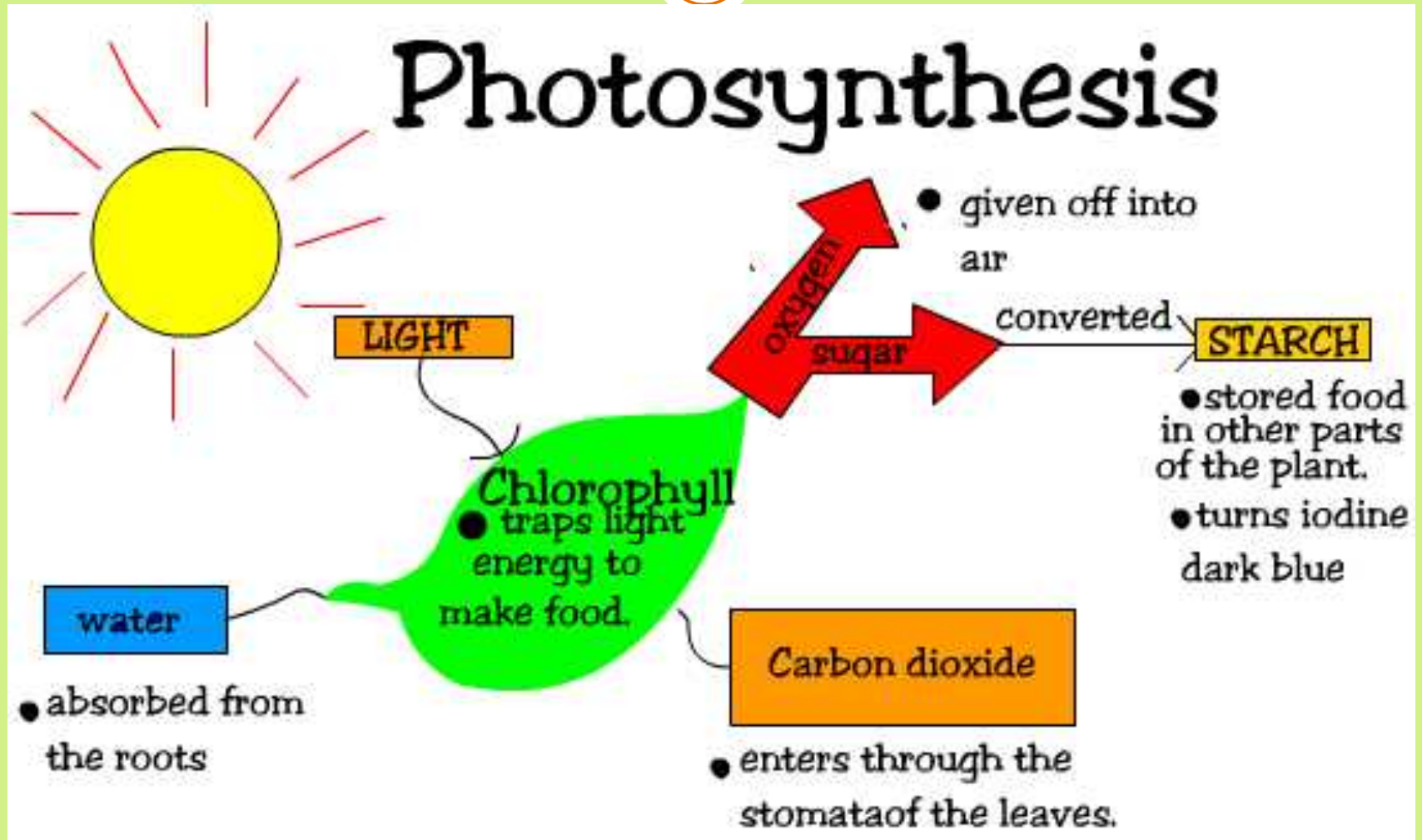
- What do leaf cells contain?

Process



- What do leaf cells contain?
- They contain chloroplasts
- Green plants use light energy and material around them to make simple sugar (their food)
- This process is called photosynthesis

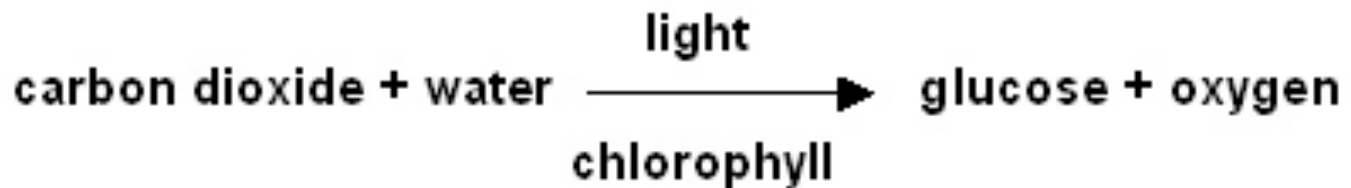
Process



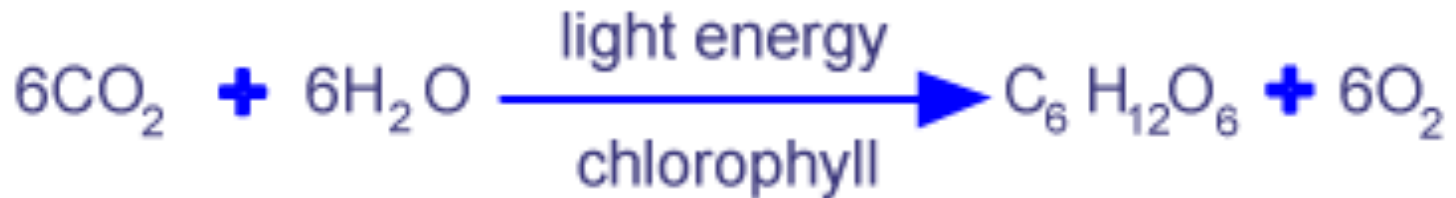
Process



- Word equation:



- Chemical equation



Process



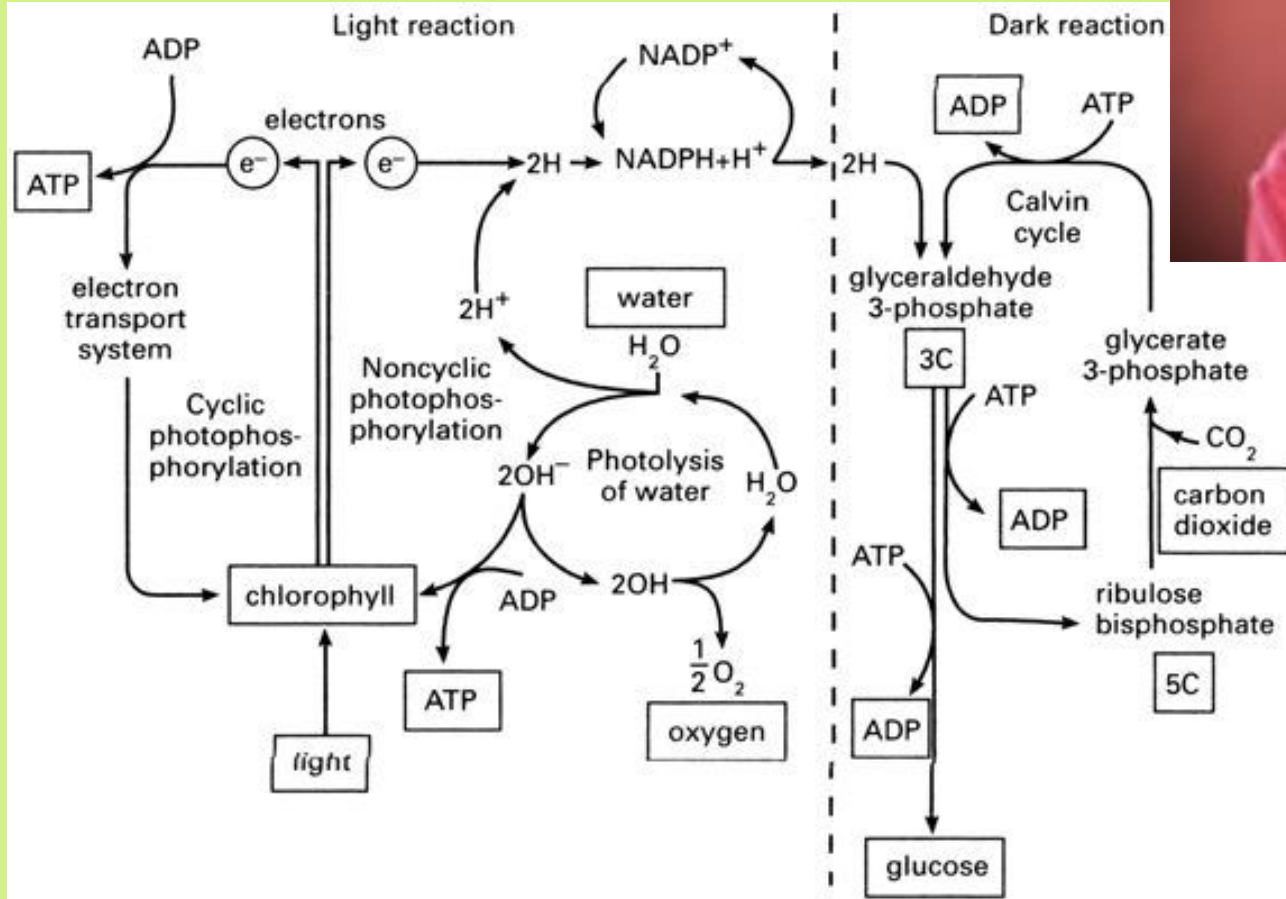
- Energy from the light gets converted into chemical bond energy in the simple sugars
- This provides energy for plant and other organisms which feed on it
- Oxygen is produced in the process (by-product)
- Oxygen is used:
 - By plant for respiration
 - Diffused out into atmosphere to be used by other organisms

Process



- Photosynthesis not simple process as we see in the equation
- Many chemical reactions take place that require different enzymes
- The equation just summarizes the different process from start to end

Process



Storing of glucose

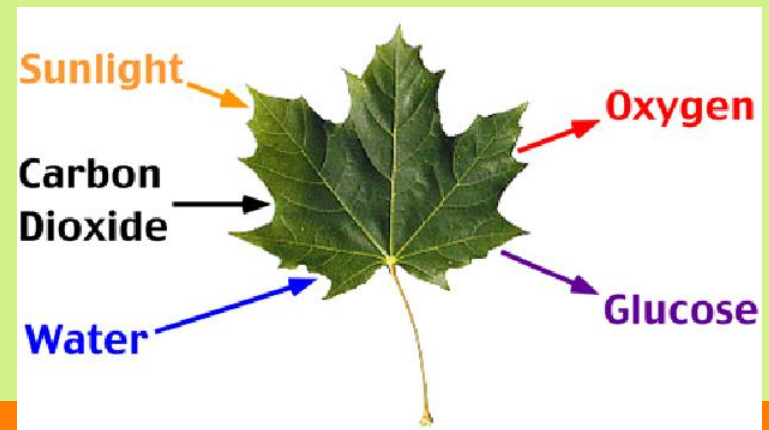


- If too much glucose remain in the plant cells, the cells would be very concentrated.
- Water FROM OTHER CELLS will diffuse in through osmosis, making the other cells swell
- To prevent this, the glucose molecules are joined to form starch which is insoluble in water

Requirements for photosynthesis



- For photosynthesis, the green plants need:
 - Light – provides energy for process
 - Chlorophyll – a green pigment that absorbs energy from light. It is in the chloroplasts of the leaf
 - Carbon dioxide – diffuses in from the air to the leaf
 - Water – absorbed by plant from roots
- **RAW MATERIAL: carbon dioxide + water**



Requirements for photosynthesis



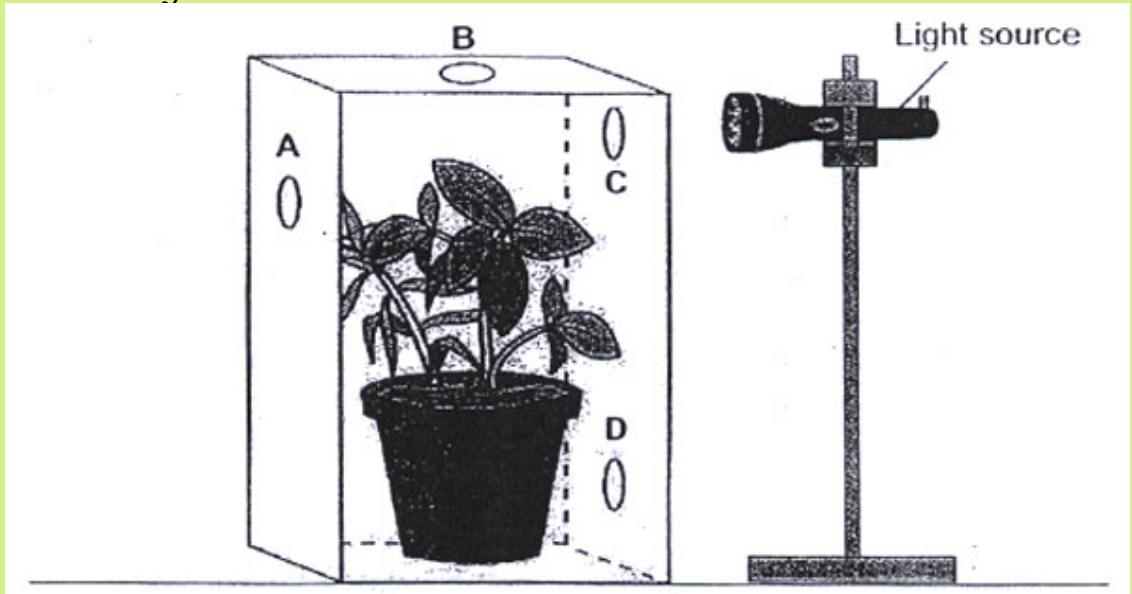
- De-starching: leaving the plant with no sunlight for at least 48 hours to remove all starch.
- This is done to test the effect of removing one of the requirements of photosynthesis
- Read pages 58/59



Requirements for photosynthesis



- De-starching: leaving the plant with no sunlight for at least 48 hours to remove all starch.
- This is done to test the effect of removing one of the requirements of photosynthesis
- Read pages 58/59



Products of photosynthesis



- **Glucose:**
 - Used for respiration
 - Turned to starch for later use (e.g. at night)
 - Used make cellulose (needed for making cell wall)
 - Turned into sucrose and transported to other parts of plant in the phloem
 - Glucose and nitrate (absorbed from soil) make amino acids
 - Sugars turned into oils to store energy in seeds

Products of photosynthesis



- **Oxygen:**
 - By-product of photosynthesis (not main product)
 - Used for respiration
 - Mostly diffused out of leaf into atmosphere (this is why we say it's a by-product)

Products of photosynthesis



- The whole plant:
 - Either directly (e.g. eating rice, potatoes)
 - when meat is consumed where the animal consumed plants
 - Oils and margarine are made from plants
 - Food for livestock
 - Raw material for industry (e.g. timber, cotton)
 - Medications
 - Provide habitat for animals and microorganisms (e.g. rainforest take 6% of world but support more than 1/2 of world species)
 - Concentrations of gases are kept balanced by photosynthesis (if photosynthesis didn't take place, there would be more carbon dioxide in air)

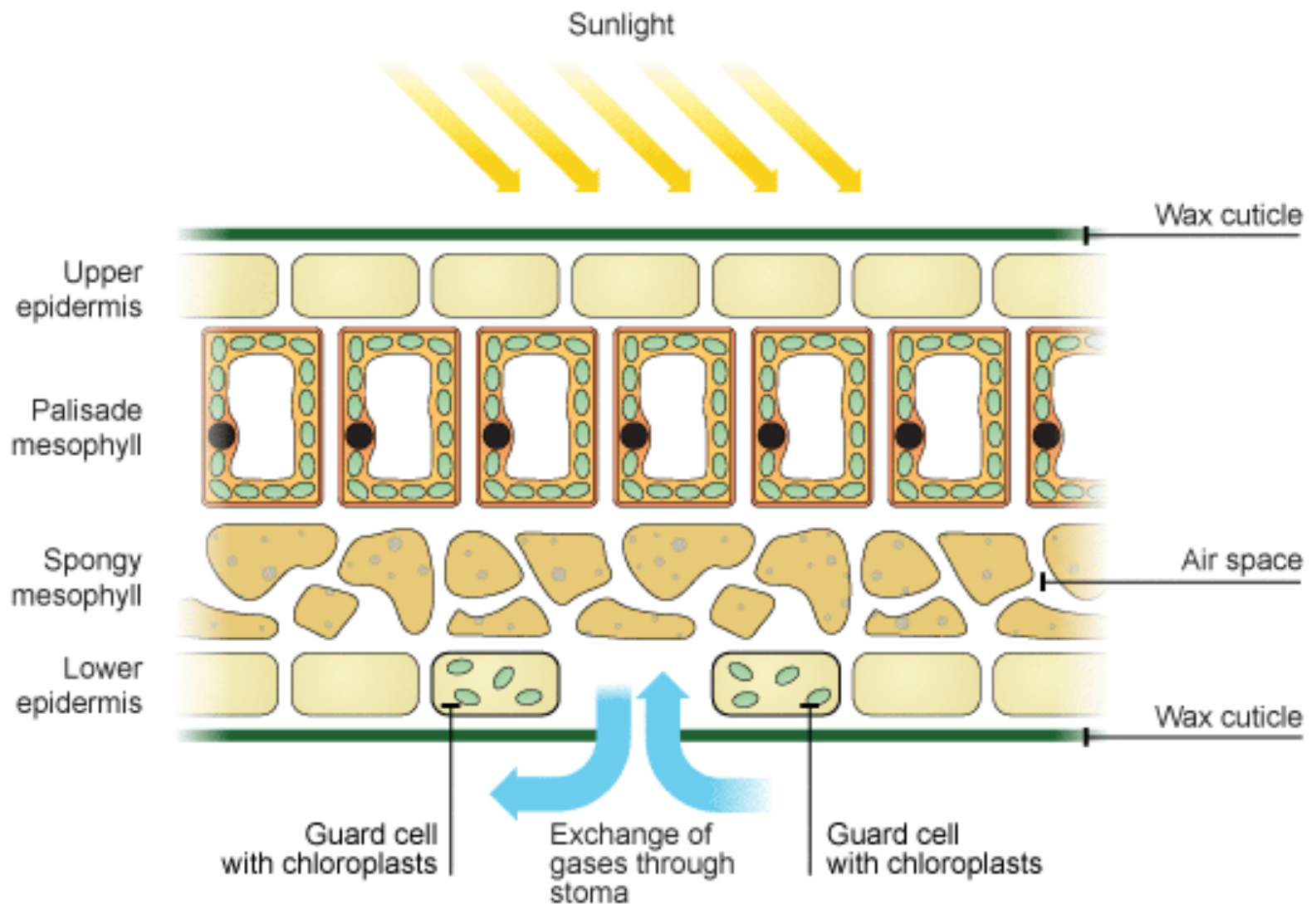
Leaf structure



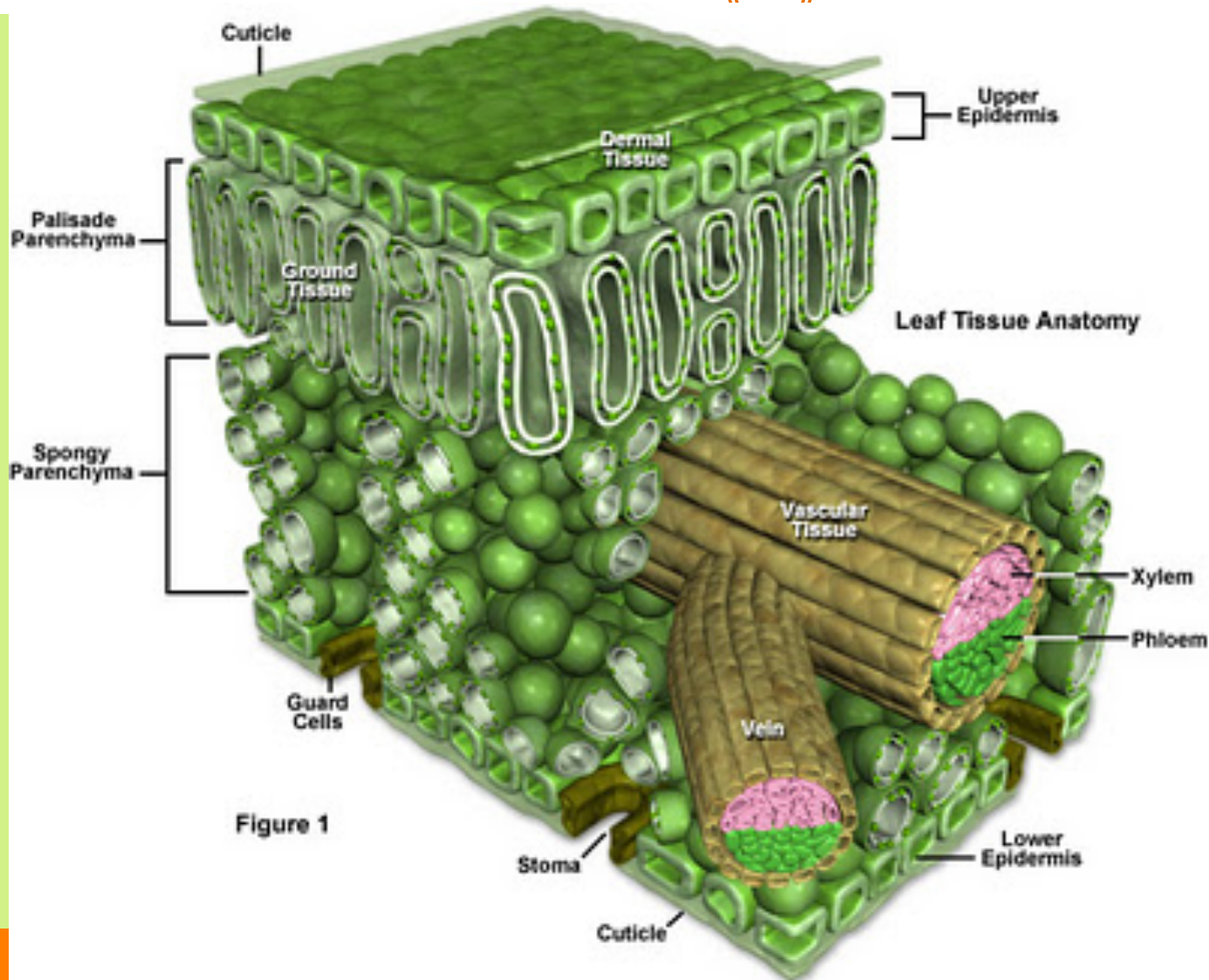
- Structure helps in carrying out its function
 - Absorb light for photosynthesis
 - Allow gas exchange in and out of leaf tissue
- Leaves features:

adaptation	purpose
Large surface area	absorb sunlight
Thin shape	so gases can easily diffuse in and out
Lots of chloroplast	to absorb light needed for photosynthesis
veins	support leaf surface – carry water and ions to leaf cells – take sucrose and amino acids away from leaf to other parts of plant
stomata	allow carbon dioxide to diffuse into leaf

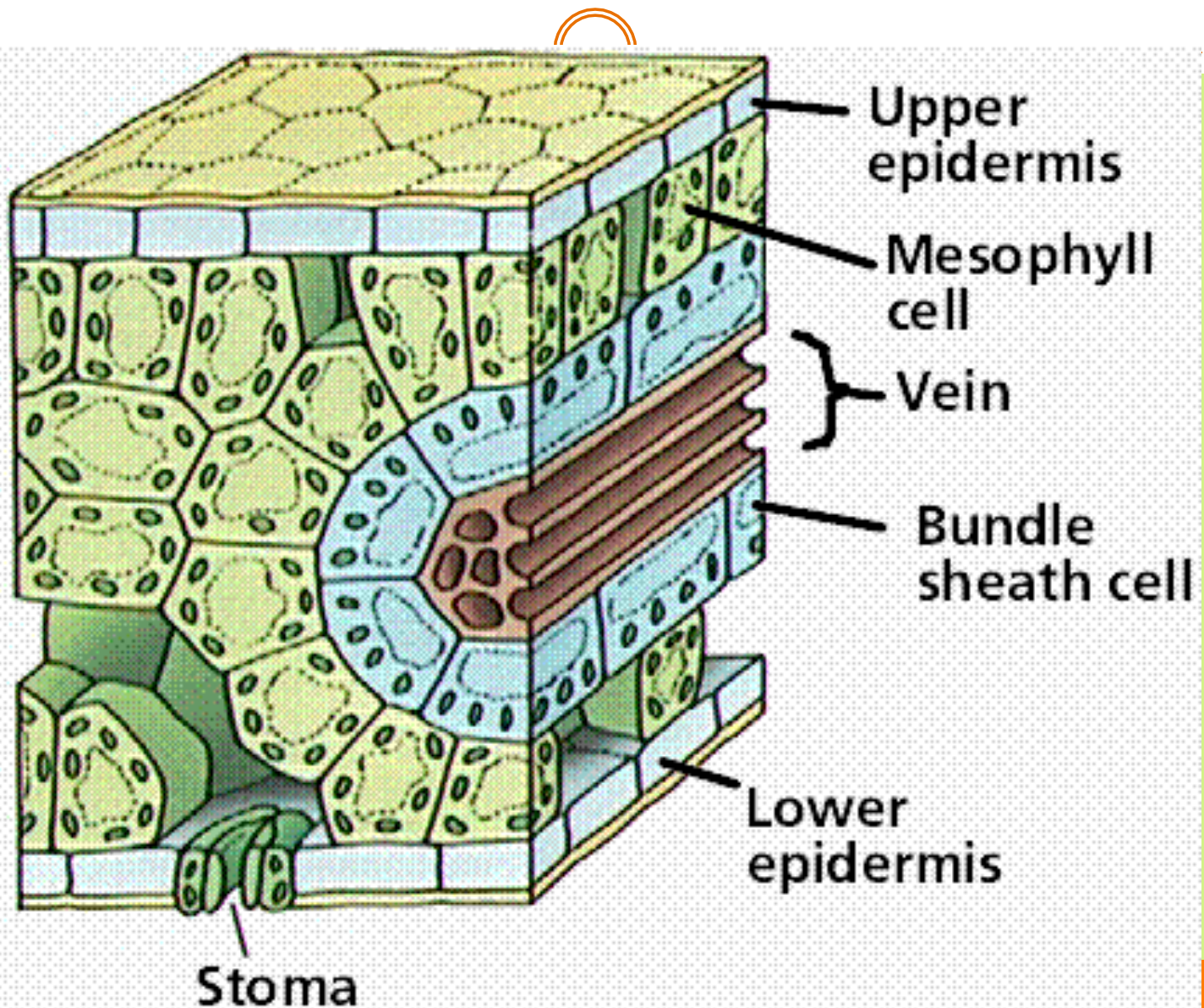
Leaf structure



Leaf structure



Leaf structure



Leaf structure

Structure	Description
Cuticle	Waterproof layer (reduces water loss from evaporation)
Upper epidermis	Single layer of cells –transparent no chloroplast – let light through easily
Palisade mesophyll	Lots of chloroplasts to absorb light – most photosynthesis take place here --
Spongy mesophyll	More rounded – lots of empty spaces for air movement – increase surface area
Veins (vascular bundle)	Xylem vessels: bring water and salts to leaf Phloem tubes: take amino acids & sucrose away
Lower epidermis	No thick cuticle – contains stomata which allow gas to diffuse in and out

Stomata

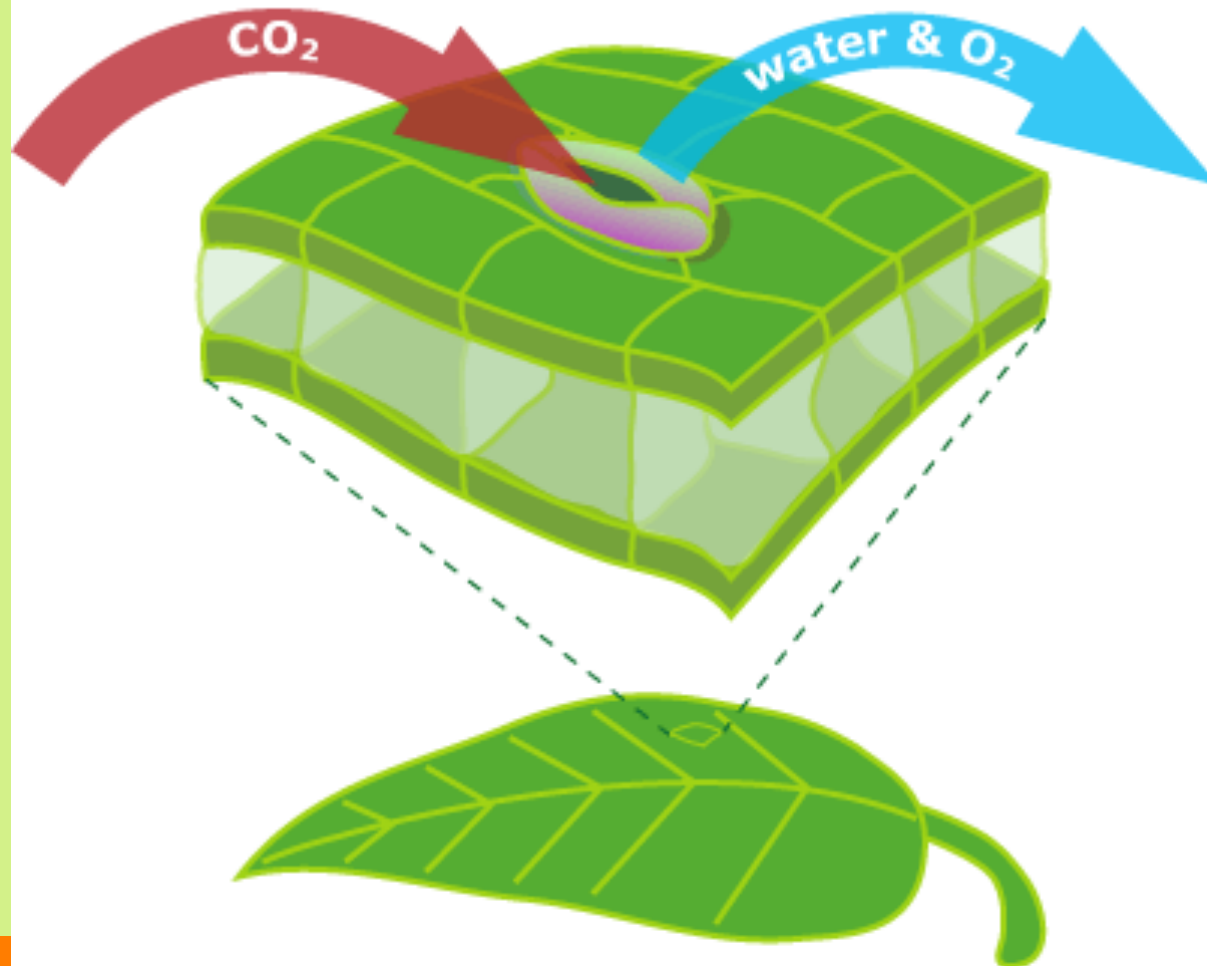


- Stomata are small pores (holes) that allow gases to diffuse in and out of leaf
- Usually in lower epidermis
- During sunlight:
 - carbon dioxide diffuses in leaf
 - oxygen and water vapour is diffused out

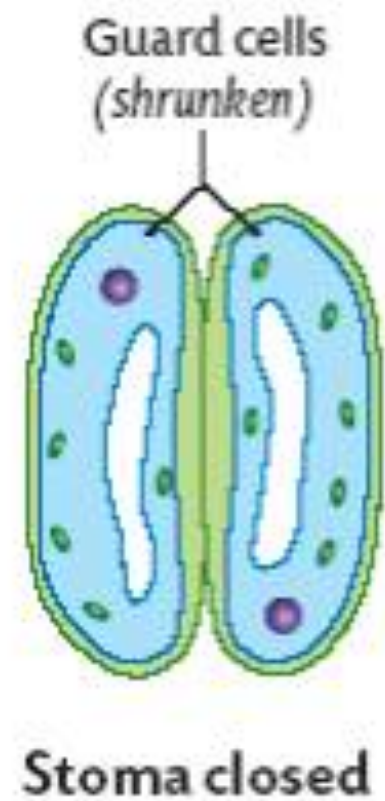
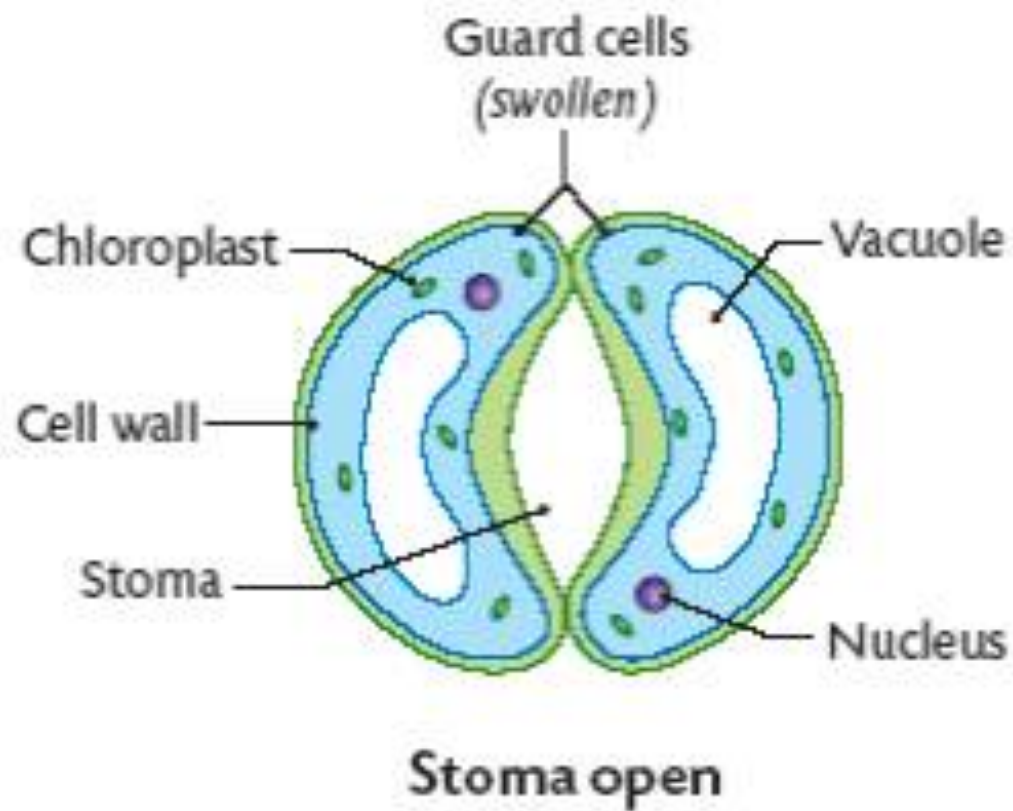
Stomata



Carbon dioxide enters, while water and oxygen exit, through a leaf's stomata.



Stomata



Stomata



- Opening and closing:
 - Controlled by guard cells
 - Stomata open during the day – how? Water passes inside guard cells by osmosis – so the plunge and bend and open (like sausages)
 - At night – water gets out of guard cells closing the gap making stomata closed. This also happens during the day in very hot and dry places to prevent water vapour lose and plant wilting

Mineral requirements



- Mineral salts (plant nutrients) are needed for growth
- Minerals absorbed from soil in small quantities by active transport
- If soil lacks these nutrients, plants show symptoms known as **deficiency symptoms**

Mineral requirements



- **Nitrates:**
 - to make amino acids to make proteins.
 - Proteins required for growth
- **Magnesium:**
 - make chlorophyll
 - chlorosis: condition where plants are deficient in chlorophyll
 - Leaves become yellow
- **Phosphates:**
 - to make DNA and needed for respiration
 - deficiency would lead to poor root growth and young leaves turning purple instead of green

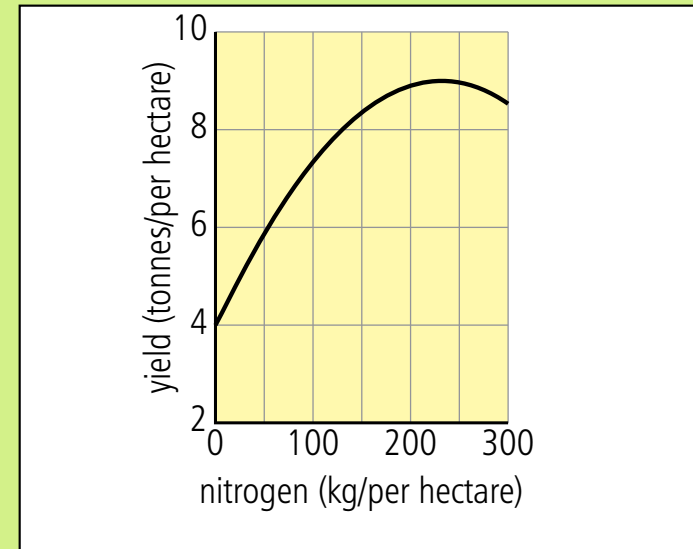
Fertilizers



- To solve lack of nutrients: farmers add fertilizers
- NPK fertilizers have:
 - Nitrogen (N) for growth of leaves and stems
 - Phosphorous (P) for healthy roots
 - potassium (K) healthy leaves and flowers



How much nitrogen, phosphorus and potassium does this fertiliser contain?



The effect of nitrogen fertiliser on the yield of wheat

Fertilizers



- Chemical or artificial fertilizers are used in huge amounts
- Farmers has need to be careful about how much fertilizer is used and when.
- Rain can wash fertilizer into rivers and streams (water pollution)
- Natural fertilizers include farmyard manure and composts (**humus**).
- Humus improves the structure of the soil.
- Natural fertilizer rots down and releases nutrients more slowly but over a longer period of time.
- The problem for the farmer is that the mass of each nutrient in the fertilizer is not known.

Fertilizers



• y

